MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2017/2018

EMT1016 – ENGINEERING MATHEMATICS I

(All Sections / Groups)

5 MARCH 2018

2.30 PM – 4.30 PM

(2 Hours)

INSTRUCTIONS TO STUDENTS:

1. This exam paper consists of **3 pages** (including cover page) with **4** Questions only.

2. Attempt **all** 4 questions. All questions carry equal marks and the distribution of marks for each question is given.

3. Please print all your answers in the Answer Booklet provided. Show all relevant steps to obtain maximum marks.

Question 1

(a) Consider the function $f(x)=\begin{cases} 1-x, & 0<x\leq 1, \\ (x-1)^2, & x>1. \end{cases}$

(i) Perform continuity test for $f(x)$ at $x=1$. Is $f(x)$ continuous at $x=1$?

[3 marks]

(ii) Sketch $f(x)$. Does the inverse function exist for $f(x)$? Provide your justification.

[3 marks]

(b) If $y=\sin(x^2y+xy^2)$, use implicit differentiation to find $\left.\frac{dy}{dx}\right|_{x=0}$.

[5 marks]

(c) Use partial fraction decomposition to find $\int \frac{1}{x(x^2-4)}\,dx$.

[8 marks]

(d) Find the increasing and decreasing intervals for $y=\sqrt{x}\,(x-6)$.

[6 marks]

Question 2

(a) Let $f(x,y)=\frac{x^2y}{x^4+y^2}$.

(i) Find $\lim\limits_{(x,y)\to(0,0)} f(x,y)$ along $y=4x$. [3 marks]

(ii) Find $\lim\limits_{(x,y)\to(0,0)} f(x,y)$ along $y=x^2$. [3 marks]

(iii) What can you conclude on $\lim\limits_{(x,y)\to(0,0)} f(x,y)$? [2 marks]

(b) Let $w=e^{xy+z}$, $x=s+t^2$, $y=\sqrt{st}$ and $z=\frac{s}{t}$. Find $\frac{\partial w}{\partial t}$ by using the chain rule.

[6 marks]

(c) By using the method of Lagrange's Multipliers, find the minimum of $f(x,y)=x^2+y^2$ subject to constraint $xy-2=0$.

[11 marks]

Continued...

Question 3

(a) Given the Maclaurin series for e^x is

$$e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!}, \quad x \in \Re .$$

Find the Maclaurin series for $f(x) = x\,e^{(2x)}$, and then provide the first four terms of the series.

[6 marks]

(b) Find the interval of convergence of the power series $\sum_{n=0}^{\infty}(n+1)!\,(x-3)^n$.

[6 marks]

(c) Let $z_1 = -3+3i$, $z_2 = 1-i$ and $z = z_1 + z_2$.

(i) Find the modulus and principal argument for z. [3 marks]

(ii) Sketch the argand diagram for z. [2 marks]

(iii) Then, express z in polar and exponential forms. [2 marks]

(d) List all the three complex roots of equation $w^3 = -2+2i$. [6 marks]

Question 4

(a) Consider the following function $f(x)$ defined on an interval of length 2.

$$f(x) = \begin{cases} x, & 0 \le x < 1, \\ -1, & 1 \le x < 2. \end{cases}$$

(i) If $g(x)$ is the periodical extension of $f(x)$ with period 2, sketch the graph of $g(x)$ on the interval $[-6,6]$. [6 marks]

(ii) If $g(x)$ is the extension of $f(x)$ as half range Fourier sine series with period 4, sketch the graph of $g(x)$ on the interval $[-6,6]$.

[6 marks]

(b) Expand $f(x) = (x-1)^2, 0 \le x < 1$ in a half-range Fourier Sine series.

[13 marks]

End of paper.